CLAIMS

What is claimed is:

1. An apparatus for mounting coupled with a power line carrying a high AC line voltage, the apparatus comprising:

a conductive body having a body capacitance;

a power supply comprising at least two input terminals; a first of said at least two input terminals coupled to said conductive body and a second of said at least two input terminals operative to be coupled to said power line;

electronic circuitry coupled to said power supply;

wherein said power supply is operative to convert power flow between said conductive body and said power line into a supply of power at a voltage substantially lower than said high AC line voltage for operation of said electronic circuitry.

2. The apparatus of claim 1 wherein said voltage substantially lower than said high AC line voltage is below 100 volts DC.

3. The apparatus of claim 1 wherein said electronic circuitry comprises:

a sensor operative to sense at least one parameter.

4. The apparatus of claim 3 wherein said at least one parameter comprises at least one of ambient temperature, internal temperature, temperature of said power line, strain, humidity, elevation, position, ambient light level, air quality, vibration, acceleration, sound level and atmospheric pressure.

5. The apparatus of claim 4 wherein said electronic circuitry further comprises:

a radio frequency transmitter operative to transmit said parameter to a remote device which is not physically coupled to said apparatus.

6. The apparatus of claim 5 wherein said electronic circuitry further comprises:

a radio frequency positioning receiver operative to receive position information and determine the position of said apparatus.

7. The apparatus of claim 5 further comprising:

a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

8. The apparatus of claim 3 wherein said electronic circuitry further comprises:

a wireless transmitter operative to transmit said parameter to a remote device which is not physically coupled to said apparatus.

9. The apparatus of claim 8 wherein said wireless transmitter is a radio frequency transmitter.

10. The apparatus of claim 8 further comprising:

a directional antenna coupled to said wireless transmitter and operative to focus radio frequency energy emanating from said wireless transmitter.

11. The apparatus of claim 8 wherein:

said electronic circuitry further comprises a processor operative to secure data incorporating said parameter; and

said wireless transmitter is operative to transmit said data.

12. The apparatus of claim 8 wherein said electronic circuitry further comprises:

a radio frequency positioning receiver operative to receive position information and determine the position of said apparatus.

13. The apparatus of claim 1 wherein said electronic circuitry comprises a current sensor operative to sense current flow in said power line.

14. The apparatus of claim 13 wherein said current sensor comprises at least one of a Hall effect sensor, a Rogowski coil, a magnetic core current transformer and an optical current transducer.

15. The apparatus of claim 13 wherein said current sensor comprises an active current transformer.

16. The apparatus of claim 13 further comprising:

at least one analog to digital converter coupled to said current sensor;

a processor coupled to said at least one analog to digital converter and operative to receive digital samples representative of said current flow in said power line from said analog to digital converter; and

a wireless transmitter coupled to said processor and operative to transmit said digital samples to a remote device which is not physically coupled to said apparatus.

17. The apparatus of claim 16 wherein said wireless transmitter is a radio frequency transmitter.

18. The apparatus of claim 17 further comprising:

a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

19. The apparatus of claim 16 wherein said wireless transmitter is a laser.

20. The apparatus of claim 16 wherein said electronic circuitry further comprises:

a radio frequency positioning receiver coupled to said processor, operative to receive position information and determine the position of said apparatus.

21. The apparatus of claim 13 further comprising:

at least one analog to digital converter coupled to said current sensor;

a processor coupled to said at least one analog to digital converter and operative to receive digital samples representative of said current flow in said power line from said analog to digital converter;

a time synchronization receiver coupled to said processor; and

wherein said processor is operative to associate at least one timestamp from said time synchronization receiver with said digital samples.

22. The apparatus of claim 21 further comprising a radio frequency transmitter coupled to said processor and operative to transmit said digital samples to a remote device which is not physically coupled to said apparatus.

23. The apparatus of claim 22 wherein said time synchronization receiver further comprises:

a radio frequency positioning receiver operative to receive position information and determine the position of said apparatus.

24. The apparatus of claim 22 further comprising a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

25. The apparatus of claim 13 wherein said electronic circuitry comprises a voltage sensor operative to sense voltage on said power line.

26. The apparatus of claim 25 wherein said electronic circuitry comprises

at least one analog to digital converter coupled to said voltage sensor and said current sensor; and

a processor coupled to said at least one analog to digital converter and operative to receive digital samples representative of said current flow in said power line and said voltage on said power line from said analog to digital converter.

27. The apparatus of claim 26 wherein said current sensor comprises at least one of a Hall effect sensor, a Rogowski coil, a current transformer and an optical current transducer.

28. The apparatus of claim 26 wherein said current sensor comprises an active current transformer.

29. The apparatus of claim 26 wherein said processor is operative to calculate power flow in said power line using said digital samples.

30. The apparatus of claim 29 further comprising a radio frequency transmitter coupled to said processor and operative to transmit the result of said power flow calculation to a remote device.

31. The apparatus of claim 30 wherein said electronic circuitry further comprises:

a radio frequency positioning receiver coupled to said processor, operative to receive position information and determine the position of said apparatus.

32. The apparatus of claim 30 further comprising a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

33. The apparatus of claim 26 further comprising a radio frequency transmitter coupled to said processor and operative to transmit said digital samples to a remote device which is not physically coupled to said apparatus.

34. The apparatus of claim 33 wherein said electronic circuitry further comprises a radio frequency positioning receiver coupled to said processor, operative to receive position information and determine the position of said apparatus.

35. The apparatus of claim 33 further comprising a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

36. The apparatus of claim 26 further comprising:

a time synchronization receiver coupled to said processor; and

wherein said processor is operative to associate at least one timestamp from said time synchronization receiver with said digital samples.

37. The apparatus of claim 36 further comprising a radio frequency transmitter coupled to said processor and operative to transmit said digital samples to a remote device which is not physically coupled to said apparatus.

38. The apparatus of claim 37 wherein said time synchronization receiver further comprises a radio frequency positioning receiver operative to receive position information and determine the position of said apparatus.

39. The apparatus of claim 37 further comprising a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

40. The apparatus of claim 36 wherein said processor is operative to produce power flow data indicative of power flow in said power line using said digital samples.

41. The apparatus of claim 40 further comprising a radio frequency transmitter coupled to said processor and operative to transmit said power flow data to a remote device which is not physically coupled to said apparatus.

42. The apparatus of claim 41 wherein said radio frequency transmitter is further operative to transmit at least one of said digital samples to said remote device.

43. The apparatus of claim 41 wherein said time synchronization receiver further comprises a radio frequency positioning receiver operative to receive position information and determine the position of said apparatus.

41. The apparatus of claim 41 further comprising a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

42. The apparatus of claim 1 wherein said electronic circuitry comprises a voltage sensor operative to sense voltage on said power line.

43. The apparatus of claim 1 wherein said electronic circuitry comprises at least one light source.

44. The apparatus of claim 43 wherein said conductive body comprises a sphere.

45. The apparatus of claim 44 where said second of said at least two input terminals comprises a clamp operative to engage said power line.

46. The apparatus of claim 43 wherein said conductive body comprises a cylinder.

47. The apparatus of claim 43 wherein said electronic circuitry comprises at least one processor operative to control the lighting of said light source.

48. The apparatus of claim 47 wherein said electronic circuitry comprises time synchronization reception circuitry operative to provide an indication of time to said processor; said processor operative to control said lighting based on said indication of time.

49. The apparatus of claim 48 wherein said time synchronization reception circuitry comprises a GPS receiver.

50. The apparatus of claim 48 wherein said electronic circuitry further comprises a light sensor operative to sense ambient lighting conditions in the vicinity of said apparatus.

51. The apparatus of claim 50 wherein said processor is coupled to said light sensor and said light source; said processor operative to illuminate said light source when said light sensor indicates said ambient lighting conditions are below a threshold.

52. The apparatus of claim 43 further comprising an energy storage device coupled to said power supply and operative to supply power to said electronic circuitry when a condition exists such that said electronic circuitry demands more power than said power supply can produce.

53. The apparatus of claim 52 wherein said condition is the illumination of said light source.

54. The apparatus of claim 52 wherein said condition is the failure of said high AC line voltage.

55. The apparatus of claim 52 further comprising:

a processor operative to control the application of charge to said energy storage device.

56. The apparatus of claim 43 wherein said electronic circuitry further comprises a light sensor operative to sense ambient lighting conditions in the vicinity of said apparatus.

57. The apparatus of claim 56 wherein said electronic circuitry further comprises a processor coupled to said light sensor and said light source; said processor operative to illuminate said light source when said light sensor indicates said ambient lighting conditions are below a threshold.

58. The apparatus of claim 1 wherein said power supply comprises a transformer having at least a primary and a secondary winding, wherein said primary winding has a greater number of turns than said secondary winding.

59. The apparatus of claim 58 wherein said power supply comprises:

a capacitor;

a rectification circuit coupled to said capacitor and operative to allow said capacitor to charge to a DC voltage from said power flow;

a controller operative to prevent and allow the flow of current through said primary winding from said capacitor;

a filter circuit coupled to said secondary winding and operative to produce said voltage substantially lower than said high AC line voltage; and

a feedback circuit coupled to said filter circuit and said controller wherein said controller uses the output of said feedback circuit to modulate said prevention and allowance of current flow in order to regulate said voltage substantially lower than said high AC line voltage.

60. The apparatus of claim 59 further comprising an energy storage device coupled to said DC voltage substantially lower than said high AC line voltage and operative to supply power to said electronic circuitry for a period of time if said high AC line voltage fails.

61. The apparatus of claim 60 further comprising a processor operative to control the application of charge to said energy storage device.

62. The apparatus of claim 59 wherein said electronic circuitry comprises a sensor operative to sense at least one parameter.

63. The apparatus of claim 59 wherein said electronic circuitry further comprises a radio frequency transmitter operative to transmit data to a remote device which is not physically coupled to said apparatus.

64. The apparatus of claim 63 wherein said electronic circuitry further comprises a radio frequency positioning receiver operative to receive position information and determine the position of said apparatus.

65. The apparatus of claim 63 further comprising a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

66. The apparatus of claim 59 wherein said electronic circuitry comprises at least one light source.

67. The apparatus of claim 59 wherein said electronic circuitry further comprises an electric motor operative to propel said apparatus along said power line.

68. The apparatus of claim 59 wherein said electronic circuitry comprises at least one of a radar transmitter, fiber optic transmitter, a power line carrier transceiver, a display, a mesh networking transceiver, a sound emitting device, a video surveillance device, an audio surveillance device, a radio frequency repeater, an information sign and an advertising sign.

69. The apparatus of claim 59 wherein said power supply further comprises at least one of a solar panel and a wind turbine.

70. The apparatus of claim 58 wherein said power supply comprises:

a rectification circuit coupled across said secondary winding;

a capacitor coupled to the output of said rectification circuit and operative to produce a DC voltage substantially lower than said high AC line voltage;

a regulator coupled to said capacitor and operative to regulate said DC voltage substantially lower than said high AC line voltage; and

wherein said primary winding is coupled in series between said conductive body and said power line.

71. The apparatus of claim 70 further comprising an energy storage device coupled to said DC voltage substantially lower than said high AC line voltage and operative to supply power to said electronic circuitry for a period of time if said high AC line voltage fails.

72. The apparatus of claim 71 further comprising a processor operative to control the application of charge to said energy storage device.

73. The apparatus of claim 70 wherein said electronic circuitry comprises a sensor operative to sense at least one parameter.

74. The apparatus of claim 70 wherein said electronic circuitry further comprises a radio frequency transmitter operative to transmit data to a remote device which is not physically coupled to said apparatus.

75. The apparatus of claim 74 wherein said electronic circuitry further comprises a radio frequency positioning receiver operative to receive position information and determine the position of said apparatus.

76. The apparatus of claim 74 further comprising a directional antenna coupled to said radio frequency transmitter and operative to focus radio frequency energy emanating from said radio frequency transmitter.

77. The apparatus of claim 70 wherein said electronic circuitry comprises at least one light source.

78. The apparatus of claim 77 wherein said electronic circuitry further comprises a light sensor operative to sense ambient lighting conditions in the vicinity of said apparatus.

79. The apparatus of claim 78 wherein said electronic circuitry further comprises a processor coupled to said light sensor and said light source; said processor operative to illuminate said light source when said light sensor indicates said ambient lighting conditions are below a threshold.

80. The apparatus of claim 77 wherein said electronic circuitry comprises time synchronization reception circuitry operative to provide an indication of time to said processor; said processor operative to control said lighting based on said indication of time.

81. The apparatus of claim 70 wherein said electronic circuitry further comprises an electric motor operative to propel said apparatus along said power line.

82. The apparatus of claim 70 wherein said electronic circuitry comprises at least one of a radar transmitter, fiber optic transmitter, a power line carrier transceiver, a display, a mesh networking transceiver, a sound emitting device, a video surveillance device, an audio surveillance device, a radio frequency repeater, an information sign and an advertising sign.

83. The apparatus of claim 70 wherein said power supply further comprises at least one of a solar panel and a wind turbine.

84. The apparatus of claim 1 wherein said electronic circuitry comprises at least one of a radar transmitter, fiber optic transmitter, a power line carrier transceiver, a display, a mesh networking transceiver, a sound emitting device, a video surveillance device, an audio surveillance device, a radio frequency repeater, an information sign and an advertising sign.

85. The apparatus of claim 1 wherein said power supply further comprises at least one of a solar panel and a wind turbine.

86. The apparatus of claim 1 wherein said electronic circuitry further comprises an electric motor operative to propel said apparatus along said power line.

87. The apparatus of claim 86 further comprising at least one of a video camera, vibrating motor and electronically driven hammer coupled to said electronic circuitry.

88. The apparatus of any of claims 1, 5, 8, 16, 22, 30, 33, 37, 41, 43, 48, 63, 74 or 84 wherein said conductive body comprises a sphere.

89. The apparatus of claim 88 where said second of said at least two input terminals comprises a clamp operative to engage said power line.

90. The apparatus of any of claims 1, 5, 8, 16, 22, 30, 33, 37, 41, 43, 48, 63, 74 or 84 wherein said conductive body comprises a cylinder.

91. The apparatus of either of claims 8 or 16 wherein said electronic circuitry further comprises:

a wireless receiver; and

a processor coupled with said wireless receiver and said wireless transmitter; said processor operative to integrate said apparatus into a mesh network.

92. The apparatus of any of claims 5, 22, 30, 33, 37, 41, 63 or 74 wherein said electronic circuitry further comprises:

a radio frequency receiver;

a processor coupled to said radio frequency receiver and said radio frequency transmitter; said processor operative to integrate said apparatus into a mesh network.

93. A method of powering an apparatus mountable coupled with a power line carrying a high AC line voltage, the method comprising:

mounting said apparatus such that a current flow occurs between said power line and the body capacitance of a conductive portion of said apparatus;

converting said current flow into a supply of power at a voltage substantially lower than said high AC line voltage; and

providing said supply of power to electronic circuitry coupled to said apparatus.

94. The method of claim 93 wherein said high AC line voltage is greater than ten thousand volts.

95. The method of claim 93 wherein said electronic circuitry comprises at least one of a voltage sensor and a current sensor.

96. A power grid monitoring system comprising at least two of the apparatus of any of claims 36-41 and further comprising:

at least two receiving devices each operative to receive data indicative of voltage from at least one of said at least two apparatus; and

at least one monitoring device operative to receive said data indicative of voltage from said at least two receiving devices and at least one of display and analyze said data indicative of voltage from more than one location on said power grid.

97. A power grid monitoring system comprising at least two of the apparatus of either of claims 38 or 43 and further comprising:

at least two receiving devices each operative to receive data indicative of voltage from at least one of said at least two apparatus;

at least one monitoring device operative to receive said data indicative of voltage from said at least two receiving devices and at least one of display and analyze said data indicative of voltage from more than one location on said power grid;

wherein said at least two receiving devices are further operative to receive said position information from at least one of said at least two apparatus; and

wherein said at least one monitoring device is operative to receive said position information from said at least two receiving devices and display the position of said at least two apparatus.

98. An apparatus for mounting coupled with a power line carrying a high AC line voltage, the apparatus comprising:

a conductive body having a body capacitance;

first means coupled to said conductive body and operative to be coupled to said power line for converting current flow between said power line and said conductive body to a supply of power at a voltage substantially lower than said high AC line voltage;

second means coupled to said supply of power for performing an electronic function.

99. The apparatus of claim 98 wherein:

said second means comprises means for monitoring at least one of said high AC line voltage and current flow in said power line;

said voltage substantially lower than said high AC line voltage is less than one hundred volts; and

said high AC line voltage is greater than ten thousand volts.

100. The apparatus of claim 25 wherein the voltage sensor comprises:

a metallic plate operative to form a first capacitance with an external reference;

a second capacitance coupled between said metallic plate and a system reference; and

detection circuitry operative to detect the voltage level on said metallic plate.

101. The apparatus of claim 100 wherein said detection circuitry comprises:

an amplifier operative to buffer said voltage level; and

an analog to digital converter operative to generate a digital representation of said voltage level.

102. The apparatus of claim 100 further comprising a high value resistor coupled between said metallic plate and a DC voltage rail and operative to maintain said metallic plate at a fixed DC voltage with respect to said system reference.

103. The apparatus of claim 102 wherein said high value resistor has a value greater than 10 Mega-ohms.

104. The apparatus of claim 102 further comprising a surge arrestor coupled to said metallic plate.

105. The apparatus of claim 100 further comprising:

an electric conductor extending from said metallic plate to said second capacitance; and

an insulator surrounding at least a portion of said electric conductor, supporting said metallic plate and preventing electric conductivity between said metallic plate and said conductive body.

106. The apparatus of any of claims 100-105 wherein said second capacitance comprises:

a bank of parallel capacitors, each of said capacitors operative to be dynamically electrically coupled and decoupled between said metallic plate and said system reference in order to form a variable capacitive divider; and

a processor operative to control the coupling of said bank of parallel capacitors and calculate the voltage on said power line using a plurality of said voltage levels when said second capacitance is switched to a plurality of values.

107. The apparatus of claim 106 further comprising:

a conductive partition operative to prevent electric fields generated within said apparatus from affecting the voltage on said metallic plate and separate said apparatus into at least a first and second chamber, said first chamber housing at least said metallic plate and said second chamber housing at least a portion of said electronic circuitry; and

a dielectric cover formed at an outside end of said second chamber and operative to protect said metallic plate from the environment.

108. The apparatus of claim 100 wherein said external reference comprises ground.

109. The apparatus of claim 100 wherein said external reference comprises a second power line.

110. The apparatus of claim 42 wherein the voltage sensor comprises:

a metallic plate operative to form a first capacitance with an external reference;

a second capacitance coupled between said metallic plate and a system reference; and

detection circuitry operative to detect the voltage level on said metallic plate.

111. The apparatus of claim 110 wherein said detection circuitry comprises:

an amplifier operative to buffer said voltage level; and

an analog to digital converter operative to generate a digital representation of said voltage level.

112. The apparatus of claim 110 further comprising a high value resistor coupled between said metallic plate and a DC voltage rail and operative to maintain said metallic plate at a fixed DC voltage with respect to said system reference.

113. The apparatus of claim 112 wherein said high value resistor has a value greater than 10 Mega-ohms.

114. The apparatus of claim 112 further comprising a surge arrestor coupled to said metallic plate.

115. The apparatus of claim 110 further comprising:

an electric conductor extending from said metallic plate to said second capacitance;

an insulator surrounding at least a portion of said electric conductor, supporting said metallic plate and preventing electric conductivity between said metallic plate and said conductive body.

116. The apparatus of any of claims 110-115 wherein said second capacitance comprises:

a bank of parallel capacitors, each of said capacitors operative to be dynamically electrically coupled and decoupled between said metallic plate and said system reference in order to form a variable capacitive divider; and

a processor operative to control the coupling of said bank of parallel capacitors and calculate the voltage on said power line using a plurality of said voltage levels when said second capacitance is switched to a plurality of values.

117. The apparatus of claim 116 further comprising:

a conductive partition operative to prevent electric fields generated within said apparatus from affecting the voltage on said metallic plate and separate said apparatus into at least a first and second chamber, said first chamber housing at least said metallic plate and said second chamber housing at least a portion of said electronic circuitry; and

a dielectric cover formed at an outside end of said second chamber and operative to protect said metallic plate from the environment.

118. The apparatus of claim 110 wherein said external reference comprises ground.

119. The apparatus of claim 110 wherein said external reference comprises a second power line.

120. The apparatus of claim 110 wherein said metallic plate comprises a conductive disk.